Explanation of the Monthly Real Dollar Estimates of Wholesale Sales

Introduction

Following the July 2022 MWTS release in September 2022, the U.S. Census Bureau released a new experimental data product featuring real dollar wholesale sales estimates. Prior to this, only nominal estimates were released.   Monthly Real Dollar Estimates of Wholesale Sales estimates were created from the nominal Monthly Wholesale Trade Survey (MWTS) sales series using product weights developed from existing Census Bureau data releases and price indexes from the Bureau of Labor Statistics (BLS).

This release includes data tables containing real dollar sales estimates and corresponding residuals for Total Merchant Wholesalers, except Manufacturers' Sales Branches and Offices, as well as the two 3-digit and eighteen 4-digit North American Industry Classification System (NAICS) wholesale subsectors. Monthly estimates are available from January 2012 forward.

Definitions

To understand this experimental data product, it is important to know the following terms:

Nominal: The value of an economic variable in terms of the price level at the time of its measurement; or unadjusted for price movements.

Real: The value of an economic variable adjusted for price movements/inflation; also known as constant dollars (CD).

Deflator: A numeric pricing measure used to change nominal values into real values.

The Monthly Wholesale Trade Survey

The Census Bureau conducts the Monthly Wholesale Trade Survey (MWTS) to provide national estimates of monthly sales, end-of-month inventories, and inventories-to-sales ratios by the kind of business for wholesale firms located in the United States. Specifically, the MWTS covers wholesale merchants who sell goods on their own account and include such businesses as wholesale merchants or jobbers, industrial distributors, exporters, and importers. Sales offices and branches maintained by

manufacturing, refining, or mining firms for the purpose of marketing their products are not covered in this report. Also excluded is NAICS Industry Group 4251: Wholesale Electronic Markets and Agents and Brokers.

The MWTS is a sample survey of approximately 4,200 employer firms. Information on confidentiality protection, sampling error, non-sampling error, sample design, and definitions is available at: Monthly Wholesale Trade: Monthly Methodology

The seasonally adjusted, otherwise called nominal, monthly wholesale sales and inventories estimates are adjusted for seasonal variation. Estimates of sales are also adjusted for trading day differences and moving holidays. Estimates of inventories are also adjusted for trading day differences. Each month, in addition to the release of the new current month estimates, seasonally adjusted estimates for the prior month and the current month of the prior year are also revised.

Bureau of Labor Statistics (BLS) Price Indexes

BLS conducts the International Price Program (IPP) to produce the U.S. Import and Export Price Indexes (MXP), which measure the changes in the prices of goods and services imported into and exported from the United States. As a principal federal economic indicator (PFEI), the import and export price indexes provide critical information for determining the strength of our nation's economy and the direction in which it is moving. (Import/Export Price Indexes: U.S. Bureau of Labor Statistics (bls.gov)).

The Producer Price Index (PPI) program, also conducted by BLS, measures the average change over time in the selling prices received by domestic producers for their output. The prices included in the PPI are from the first commercial transaction for many products and some services.
(Producer Price Index Home: U.S. Bureau of Labor Statistics (bls.gov)).

Estimation

The real dollar estimation process uses seasonally adjusted, nominal wholesale sales data to provide the best information possible, without showing seasonal impacts. A typical month involves not only incorporating the latest month but also revising data from the four prior months and current month prior year.

The process is made up of two parts: generating deflators and calculating the real dollars. Deflators are generated at the four-digit industry level for durable and non-durable goods. Applying these deflators to seasonally adjusted data produces the fixed-weighted dollars. The fixed-weighted dollars are then chained (using the methodology explained in the methodology section). Both the fixed-weighted and chain-weighted

methodologies were used to generate the values displayed in the Real Estimates of Monthly Sales for Merchant Wholesalers Table.

We use the Import Price Index (IPI) series and the Producer Price Index (PPI) provided by the Bureau of Labor Statistics (BLS) to calculate the fixed-weight deflators which are used to price adjust at the four-digit NAICS level. From there, the chained dollar process is used to price adjust at the aggregated two- and three-digit NAICS levels.

Rebasing is likely to be conducted following the benchmarking of the MWTS to the Economic Census every five years. This process changes the year the real dollars are based on, referred to as the base year.

Concepts

The Real Dollars Experimental Product used Fixed-weighted real dollar adjustment for the 4-digit NAICS industry adjustment. The Fisher chain-weighted (CWD) method was used for the aggregate Total Wholesale, Total Durable, and Total Nondurable adjustment based on research done for the Census Bureau's FT900, "U.S. International Trade in Goods and Services".

The fixed-weight deflators are calculated by dividing the BLS index by the rebase value. For example:

$$Current\ Month\ NSA\ Deflator_{e,t} = \frac{Index_{e,t}}{Rebase\ Value_{e,BYR}}$$

In the equations, BYR = The base year
e = 4-digit industry
t = Current period

The seasonal value is then divided by the deflator to calculate the fixed-weighted CD or real dollars.

$$Real\ Dollars_{e,t} = \frac{Seasonal\ Adjusted\ Value_{e,t}}{Deflator_{e,t}}$$

This fixed-weighted dollars are then used to calculate values for the Laspeyres and Paasche Indexes.

Finally, chained dollar (CWD – chain-weighted dollars) values for Fisher price and quantity methodologies are calculated. Census publishes the Fixed-Weighted Dollars at

the four-digit NAICS and Chain-Weighted Dollars at the aggregated levels in the monthly MWTS.

Methodology

The CWD methodology uses fixed-weighted deflators to estimate the price (p) of each good and fixed-weighted real dollars (seasonally adjusted current dollar value ÷ deflator) to calculate the Fisher Quantity Chain-Weighted Dollars (q).

After calculating the fixed-weighted dollars, the next step is to calculate Paasche, Laspeyres, and Fisher indexes for all import, domestic or import and domestic industries (for example: import and domestic motor vehicle & motor vehicle parts & supplies) for each processing month and year based upon the prior processing month:

$$Paasche\ Quantity\ Index_{C,t} = \frac{\sum_e p_{e,t}*q_{e,t}}{\sum_e p_{e,t}*\ q_{e,t-1}}$$

$$Laspeyres\ Quantity\ Index_{C,t} = \frac{\sum_e p_{e,t-1}*q_{e,t}}{\sum_e p_{e,t-1}*\ q_{e,t-1}}$$

In the equations, t = the current processing month and year, t-1 = the prior processing month,
C = the import or domestic aggregated category,
p_t = deflator for 4-digit industry e in time period $t,$ and
q_t = seasonally adjusted current dollar value for 4-digit industry e in time period t divided by deflator for 4-digit industry e in time period t.

$$Fisher\ Quantity\ Index_{C,t}\ =\ \sqrt{Paasche\ Quantity\ Index_{C,t}*\ Laspeyres\ Quantity\ Index_{C,t}}$$

These month-to-month Fisher indexes are then chained together from the first time period (t_1) to create a chain type index with base period t_1:

$Chain\ Type\ Quantity\ Index_{C,\ t}$ = $Fisher\ Quantity\ Index_{C,t}$ * $Chain\ Type\ Quantity\ Index_{C,t-1}$

The Chain Type Quantity Index for base period t_1 is set equal to 1. The Chain Type Quantity Index is then adjusted to the desired base year (currently 2012) by dividing by the average Chain Type Quantity Index for the base year (BYR):

$$\text{Fisher Chained Quantity Index}_{C,t} = \frac{\text{Chain Type Quantity Index}_{C,t}}{\text{Average Chain Type Quantity Index}_{C,BYR}}$$

The Fisher Chained Quantity Index and base year Average Current Dollar Value are used in calculating the real value in chain-weighted dollars:

Chain-Weighted Dollar Value$_{C,t}$ =

Average Current Dollar Value$_{C,BYR}$ * Fisher Chained Quantity Index$_{C,t}$

Source of Deflators

The price index ratios used in calculating the not seasonally adjusted (NSA) price deflators were based on the average 2012 price index values. Whenever possible, the higher level BLS price index series were used to mitigate the risks/challenges posed by the discontinuation of an individual price series or group of series.

Sales and shipments data from the 2012 Economic Census as well as import data from the Census Bureau's International Trade Indicator Program were used to determine the weight percentages that were applied to each relevant product line within a given four-digit NAICS. Those product line percentages were then used to help calculate the overall deflator value used to price adjust the four-digit NAICS sales. Only overall product lines with unadjusted weight percent over a cutoff value were analyzed for domestic and import splits. The rest were analyzed with domestic price indexes only.

MSBO's, by definition, are associated with domestic manufacturers, and, therefore all the import values were attributed to merchants excluding MSBO's. No imports were allocated to MSBO's. The domestic portion comprises the difference between the product line total and the import value.

We then matched the product categories to the PPI and MXP series to identify the appropriate price indexes. Service product lines were excluded from calculating the weights for the various wholesale NAICS codes.

Comparing Fixed- and Chain-Weighted Methodologies

The fixed-weighted and chain-weighted methodologies use the same data, but in different ways. The advantage of the fixed-weighted real dollar series is its simplicity. The fixed-weighted value is a simple division of the seasonally adjusted current dollar value for each industry by the appropriate deflator. The value for each published category is obtained by summing the deflated values for each 4-digit NAICS code in that

category. This methodology has several disadvantages. The selection of the base year can significantly affect the month-to-month changes, so that estimates of growth can change significantly when a fixed-weighted series is rebased. This methodology also is affected by substitution bias. The fixed-weighted method does not allow for goods to be substituted for one another when relative prices change; it assumes that changes in price do not affect the amount of goods purchased.

In contrast to the fixed-weighted, the CWD methodology minimizes substitution bias. This methodology compares each month to the previous month, weighting those changes by the importance of each good in both periods and chaining back to the base period. Changes in the goods traded are incorporated very quickly into the deflators, thereby minimizing substitution bias, and rebasing does not affect month-to-month changes.

One obvious difference between the fixed-weighted and chain-weighted methodologies is that the CWD are not additive. For example, the sum of the 4-digit industries for durable goods in Table 1 does not sum to total durable goods. The 'residual difference' between the sum of the categories and the total will vary from month-to-month. These residuals are displayed in the time series files. As the CWD move further from the base year, the residuals tend to become larger.

Limitations

The deflators we use are not seasonally adjusted (NSA). In the future, we may investigate seasonally adjusting these deflators as that is recommended by the Bureau of Economic Analysis (BEA). The deflators are based on the 2012 values currently because the current MWTS sample is based on the 2012 Census and NAICS. In the future this will be rebased to the 2017 basis to make use of the 2017 Economic Census when MWTS is benchmarked to 2017.

The MWTS sample is controlled to ensure the representativeness of the NAICS industries within a published level, but this does not guarantee the selected companies have a similar product composition to the universe. Additional variance may result from fluctuation in the product composition between months. Product weights are derived from the annual product estimates from the 2012 Economic Census.

Additionally, there are variances associated with the BLS price indexes. Any of these variances would be included as part of the non-sampling error for this experimental product. Currently we do not have non-sampling error measures available but future research could explore how to incorporate these into variance measures. For more information on the sampling and measures of error, please refer to Monthly Wholesale Trade: Monthly Methodology.

References

For further information on Census procedures for adjusting Monthly Wholesale Trade Survey for price changes, email us at econ.real.wholesale@census.gov. The Census Bureau invites users to provide feedback on how to improve this experimental product.

For more information on price adjustment and the U.S. Census Bureau's Economic Indicator Programs, please see our latest blog at https://www.census.gov/retail/mrts/www/MARTS_Blog_1.pdf

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